Space Weather Forecast

Issued on Friday 11 October 2024 at 13:05 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Very gradually waning CME effects in course. Decreasing likelihood of Major/Moderate geomagnetic storm (G2/3). Solar radiation storm (S-scale) events now less likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Moderate, with the peak flare in the period a Moderate-class X-ray flare from the now-departed very active sunspot on the southwestern solar horizon (the same one responsible for the Strong-class on 03 October - this event on the third was the largest of the current solar cycle so far).

There are now six sunspot regions on the facing side of the Sun. There are three main areas of the Sun that currently harbour sunspot regions. Perhaps the most pertinent of these was in a region in the southeast which showed areal growth, proliferation of central spots and spreading.

No further Earth-directed Coronal Mass Ejections (CMEs) have been observed. A large 'filament' (arc of plasma) in the northwest-centre of the Sun is for the moment stable but is being monitored given its location (being in a prone location to become an Earth-directed CME should it lift-off with sufficient impetus).

Solar Wind / Geomagnetic Activity: This 24-hour period started in a slow solar wind regime. This was very abruptly replaced by the awaited Strong-class X-ray flare-related 09 October CME at 10/1448UTC at near-Earth satellites.

The CME transited the million miles from these satellites (at L1) in around half an hour to hit Earth-based magnetometers at 10/1515UTC, whereupon BGS Hartland recorded a sudden impulse in its H-component of 75.6nT in one minute. For reference, the 10 May 2024 Extreme Geomagnetic Storm event was 223nT in two minutes here.

The solar wind speed started slightly elevated but rose to become very strong just before 10/1500UTC. A gradual waning trend then ensued before a late resurgence to strong levels into the current UTC morning. The number of particles in the solar wind was very erratic, but peaked above average during the CME shock around 10/1700UTC.

The associated magnetic field was initially at background but showed a slight ramp immediately prior to the CME. Once arrived, the CME shock reached very strong values. The CME signature evolved into a 'magnetic cloud' at 10/2200UTC (with a solar wind temperature decrease observed)

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

and the magnetic field jumped further. The character of this field was perfectly anti-aligned with Earth's at this time to maximise its potency (being negative but smaller in magnitude prior to this). This strong anti-alignment then continued for much of the remainder of the reporting period, very gradually waning in intensity. The field did not rotate significantly away from opposition until after 11/0900UTC, and even then only temporarily.

Resulting geomagnetic activity was very disturbed through this reporting period. Initially quiet, four straight periods of Severe geomagnetic storm G4 were then observed from 10/1500UTC (a Kp '9-' was erroneously assigned as a G5 in an alert for 10/2100-2400UTC - the correct scale value is G4). A slight waning has since been observed into the current UTC day.

Energetic Particles / Solar Radiation: Solar radiation has continued its response to the CME-related X-ray flare from 09 October. 10MeV protons started the period at 770pfu (Moderate solar radiation storm S2) and rose in the snowplough-effect ahead of the inbound CME to a peak of 1810pfu at 10/1515UTC (Major solar radiation storm S3) before waning - a trend that accelerated after the CME magnetic cloud's onset. Levels and have since shown a very gradual downward trend to finish near 3pfu (i.e. sub-S1, minor solar radiation storm levels).

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate-class X-ray flares (Minor R1 radio blackouts) remain likely through this four-day period given sunspot developments on the Sun, their complexity, and up to four arrivals over the eastern solar horizon to round out the current UTC working week. The trend is level throughout - pending assessment of arriving regions, with none departing.

Solar Wind / Geomagnetic Activity: The CME from the 09 October Strong-class X-ray flare and 'filament eruption' is continuing to affect Earth, but its intensity continues to wane. This is the only CME in the forecast. Either of a pair of potential 'coronal hole' fast winds may affect Earth late day 3 (Sunday 13 October), although confidence in their effects being felt is low.

Initial Major geomagnetic storm G3 conditions remain possible but should continue to ease though day 1 (Friday 11 October) as the CME effects wane. G1 Minor geomagnetic storm intervals may feature early day 2 (Saturday 12 October), but should wane further as the weekend progresses. Quieter activity is then expected days 3 and 4 (13-14) with a low confidence slight chance of G1 should either of the coronal holes' fast winds impinge on Earth.

Energetic Particles / Solar Radiation: The risk of S1/Minor solar radiation storms should return to the residual risk for the current crop of sunspot regions by day 3 (Sunday 13 October). This accounts for the initial raised levels in the near-Earth environment (making any further enhancements more liable to tip above S1) and the presence of the large active region over the western solar horizon. Eastern arrivals do not feature (being too far from a prone location).

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	90	50	5	5
Strong	G3	Yes	50	5	1	1
Severe	G4	Yes	20	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X-Ray Flares

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	Yes	65	60	60	60
Very Active	R3-R5 (X Class)	No	15	10	10	10

Solar Radiation Storms (High Energy Protons)

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	Yes	40	25	20	20
Very Active	≥ S3 *	Yes	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.